

NASA TECH BRIEF

Marshall Space Flight Center



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Zone Radiometer Measurements on a Model Rocket Exhaust Plume

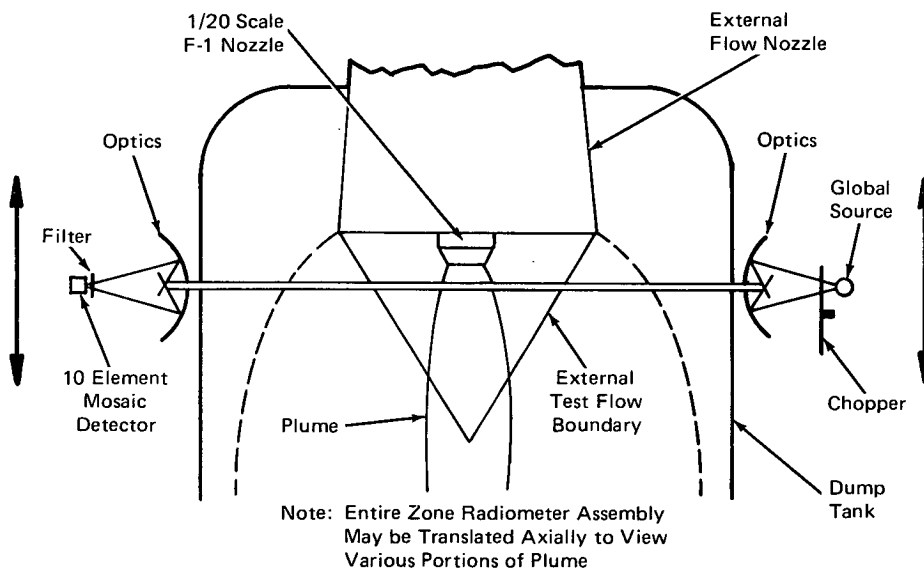


Figure 1. Zone Radiometer Arrangement In Test Chamber

The zone radiometer is an instrument developed for use in analytical prediction of rocket plume-to-booster thermal radiation and convective heating. The device (see Figure 1) measures spectral radiance and transmission across a number of chordal line of sight "zones" through the rocket plume on a millisecond time scale. The resultant radiance and transmission data can be used to calculate radial distribution of the plume temperature and, under certain conditions, concentrations of certain gas species in the plume. Although neither the instrument nor the technique is new, the particular method of application (see Figure 2) appears quite unique. The radiometer and associated data analysis techniques could be useful in engine combustion analysis, incineration, and pollution control via high temperature processing.

Although the studies performed for this particular

analysis were of an exploratory nature and, as a result, did not allow any of the test variables to be examined in any detail, the zone radiometer instrumentation system was developed to operational status and proved to be an excellent diagnostic tool. In conjunction with the short duration rocket testing technique, the instrument forms the basis for an economical means of obtaining data that can be applied toward the theoretical modeling of, for example, rocket plume-to-vehicle thermal radiation and plume after-burning effects with secondary flows. Such data can also be used by researchers interested in combustion chamber design, combustion instabilities, and nozzle performance. For some of these applications it is clearly a more appropriate diagnostic tool than other optical or conventional fluid dynamic probing techniques.

(continued overleaf)

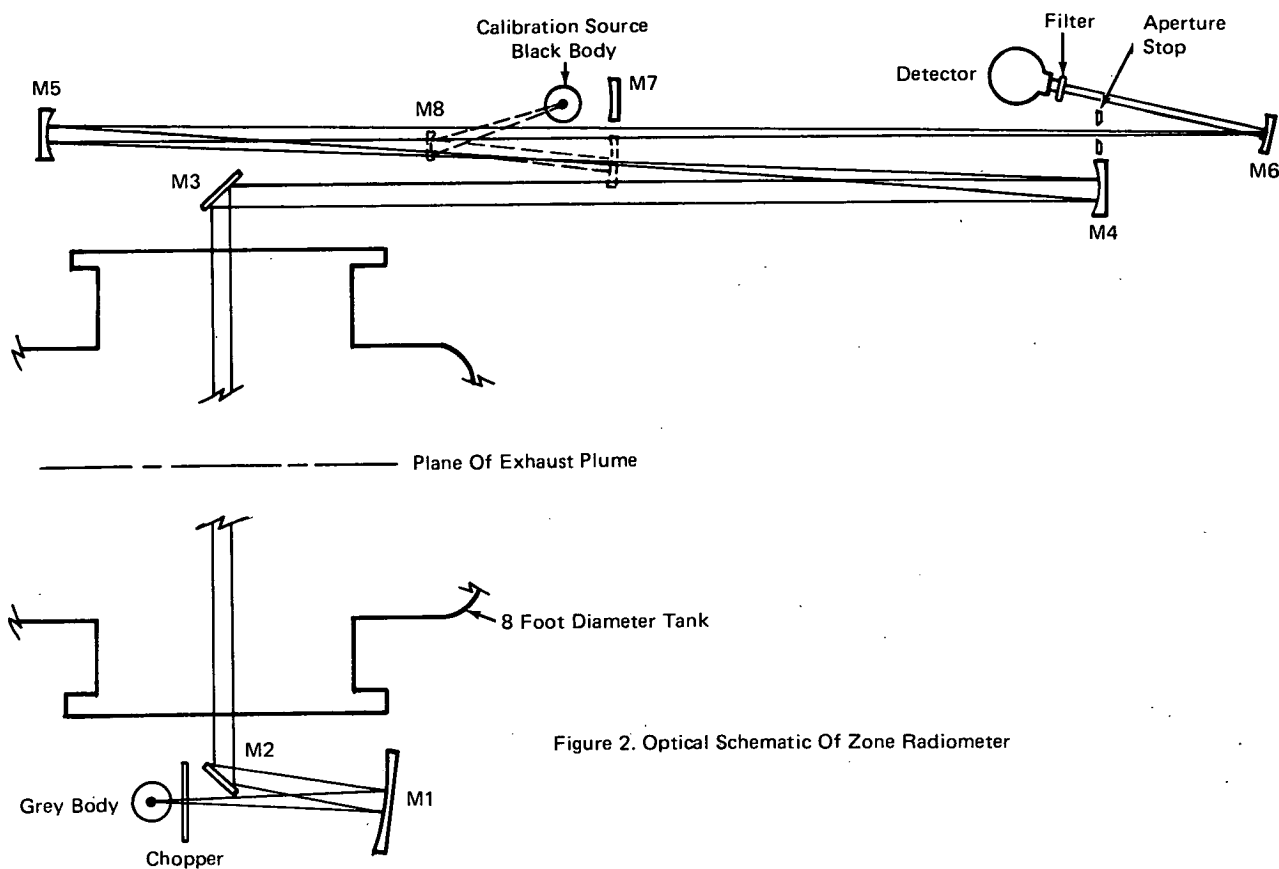


Figure 2. Optical Schematic Of Zone Radiometer

Notes:

1. Information concerning this innovation may be of interest to those engaged in pollution control and the automotive and optical instrumentation industries.
2. Requests for further information may be directed to:
 Technology Utilization Officer
 Code A&TS-TU
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 Reference: TSP72-10357

Patent status:

No patent action is contemplated by NASA.

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